PROFESSIONAL ENGINEER

Official Publication of American Association of Engineers

Mackinac Bridge—the Bridge that "Could Not be Built"—was Dedicated in June, 1958. Dr. D. B. Steinman, Consultant and Bridge Designer.

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WILEY BOOKS

AIRCRAFT AND MISSILE PROPULSION, Vol. I

By M. J. Zucrow, Purdue University. This is the initial volume in a th volume work that will discuss the fundamental principles governing the fu tioning and operating characteristics of engines employed for propelling hi speed aircraft and missiles. Volume I is concerned with the thermodynamics fluid flow and its application to propulsion engines. Nomenclature of a cha precedes the chapter; all derivations are explained in detail; an unusually la number of illustrative problems are worked out completely. *1958. 538 pa $11.50.*

AIR CONDITIONING AND REFRIGERATION

By the late William H. Severns and Julian R. Fellows, University of Illin A broad coverage that includes data on such topics as thermodynamics, fl mechanics, combustion, and fuel selection. The authors provide clear, us descriptions of the devices employed in the control of air conditioning and cuss the problems involved in specific types of plants. Included are example typical calculations. *1958. 564 pages. $10.25.*

THE METALLURGY OF VANADIUM*

By William Rostoker, Armour Research Foundation. Offers a full discus of vanadium—an element which, in recent years, has joined the ranks of me which can be produced in a state of purity that will admit of formability and therefore serve as an alloy base. The author provides a comprehensive treatm of the extraction, properties, and processing of vanadium. *1958. 185 pages. $8*

SWITCHING CIRCUITS AND LOGICAL DESIGN

By Samuel H. Caldwell, Massachusetts Institute of Technology. Deals w the methods used to handle the problems of circuit synthesis using various ki of components, and presents the principles of switching circuit design. It p vides the fundamentals which promote a knowledge of the complex applicati of switching theory. The material has been organized to help the reader ach an understanding that will enable him to create his own methods for hand new problems in the field. *1958. 685 pages. $14.00.*

ZONE MELTING*

By William G. Pfann, Bell Telephone Laboratories. Gives all the infor tion needed to plan a zone melting process or to decide whether one is feasi The author covers both the theory and practice, touching on every signifi publication which has appeared since the first basic paper went to print in 19 A major feature of work is its description of the fundamentals of freezing two component system. *1958. 236 pages. $7.75.*

*Publications in The Wiley Series on the Science and Technology of Materials, J. H. Hollomon, Advisory Editor.

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M. E. McIVER, Editor

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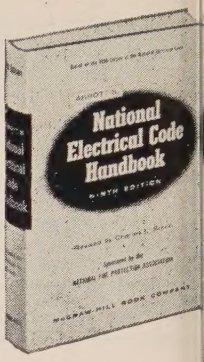

Abbott's NATIONAL ELECTRICAL CODE HANDBOOK

JUST PUBLISHED—Here is the electrical contractor's job book completely revised to conform with the 1956 Code requirements and planned to enable electricians to understand and do work in accordance with the National Electrical Code. Gives explanations of the rules and measurements for various types of jobs—what they mean —how to apply them. Diagrams, sketches, and illustrations are used freely. Revised by **Charles L. Smith,** Electrical Field Engineer of the National Fire Protection Association. **9th Edition, 642 pp., 5½ x 8, 394 illus., 34 tables, $8.00.**

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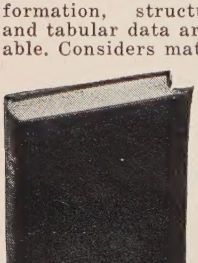
JUST PUBLISHED—Gives answers to both routine and specialized questions regarding the choice of engineering materials. Technical tables, design information, structural characteristics, and tabular data are made quickly available. Considers materials from the viewpoint of engineering structures, machinery, and equipment. Emphasis is on the fabricated forms of materials. Prepared by a staff of 150 Specialists; Edited by **Charles L. Mantell,** Consulting Engineer and Newark College of Engineering. **1906 pp., 6 x 9, 648 illus., $21.50.**



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A.A.E. BOOK DEPARTMENT

8 S. Michigan Ave. Chicago 3,

George Madgouranis

U_R *The Human Factor*

By George C. Madgouranis, Architectural Engineer
President Chicago Chapter A.A.E.

GINEERING is known as a precise and exact science, with which ertain facts can be determined. But the Art of Living is not easily ed.

For example, the equation for the change in length of a body due to nsion $e = k \cdot 1 \ (t_1 - t_2)$, or the equation for the stress induced in a member under bending $f_s = M_s \div S_s$ is well known and accepted as h. However, the equation of life Living=(Knowledge+Experience) · s one that many of us do not know or accept as truth. Knowledge e proved by certain tests. Experience can be set at a definite value. how can one evaluate U_R the Human Factor, which must take into nt many tangible and intangible values? Speech, dress, conduct, and ng—all these have tangible and evident values. Personality, ability t along with others, self-discipline, self-improvement, community

service—these are the intangibles. The mere existence or understanding these values must not in itself mean a solution of the U_R factor.

Each of us should ask himself "How can I correctly solve the equati Living = (Knowledge + Experience) · U^R?".

We know that in any equation the correct and final truth is the prop and select judgment of all factors involved. Perhaps too many of us ha the knowledge and experience, but have ignored the U_R factor. To do is a grave misjudgment on our part.

Engineers, as a group, are introverts. This is evidently due to th training and education. Many can solve intricate and difficult problen yet cannot give expression to their thoughts when called upon to do They are especially inarticulate when it comes to subjects outside their o specific field. Educators now realize this, and are giving intensive thoug on how to correct the problem. There is one solution available to us. It to get up on our feet and express ourselves at every opportunity. We m project our thoughts and personality into the spoken word—a feat wh many of us will find difficult to do at first. Remember that practice ma the difficult seem easier. And, what better way to begin than in an A.A chapter meeting or any other engineering group where engineers are p mitted and in fact encouraged to discuss their problems?

Common sense is another intangible value that gives meaning to U_R factor. We solved our problems by common sense before we gained knowledge and experience. However, many lose this very important se we call common.

The ability to get along with others is one of the most import intangibles. Without this, the equation for Living can never be solv It is with this intangible that we must concern ourselves most above others. And this is the one that many of us lack, to the detriment ourselves and the profession.

Many feel that self-improvement is of no value. This is an error. S improvement adds immeasurably to the man. Not only does it help k him abreast of the developments in his own profession and those in ot professions and fields, it also assures him of a broader understanding life. Never was it more important than it is today that engineers keep th selves fully informed and in tune with our fast moving civilization.

Engineers have roamed far afield to bring good living and progr to the less civilized parts of the world. Yet they are slow to see how t special skills can help their own communities become better places in wh to live . . . They fail to accept their civic responsibilities and in turn public fails to make free use of their excellent training and skill in planning and execution of engineering projects.

Mackinac—the Bridge that Couldn't be Built Is Dedicated

HE MACKINAC BRIDGE, the longest suspension bridge in the world, was officially dedicated on June 28 in Marquette Park, Mackinac and, Michigan. At a luncheon meeting on June 25, Postmaster General hur E. Summerfield spoke before an enthusiastic crowd dedicating new Mackinac Bridge U.S. commemorative postage stamp. The cial First-day cancellation is unique in that the postmark from both Ignace and Mackinaw City Post Offices reads "Mackinac Bridge, higan," and it is the first time the post office department has author- l an identical First-day of issue postmark for use in two cities.

The bridge spans the four-mile-wide Mackinac Straits which links vast forests and rich mineral lands of Upper Michigan with Michi- 's industrial Lower Peninsula.

"Great tribute is due David B. Steinman who designed this longest, t costly suspension bridge ever known to mankind," said General merfield. "He is one of the giants of his day, a man who has served esigning or consulting engineer in the construction of more than 400 ges on five continents, with eight of them winning awards as the t beautiful in America."

The remarkable engineering feat has been widely publicized both chnical journals, magazines and newspapers, and well it should be use it fulfills the dreams of two people in particular. Prentiss M. wn, and Dr. Steinman, both of whom celebrated their birthdays in month in which the World's Greatest Bridge was dedicated.

Two Boys Envision a Future Bridge

"Sixty years ago," says the Chicago American, in a special UPI se, "a boy of 9 stood on the shore at St. Ignace and gazed across miles of water to the other shore. There was talk, even then, of ling a bridge across—but men said it was impossible. The water deep and treacherous. Still this boy dreamed of one day seeing a ecting link.

"At the same time, nearly 1,000 miles away in New York City, a boy sold newspapers in the shadow of the Brooklyn Bridge. He mar- l at the great bridge and dreamed that one day he would build a er and a better one. This boy's name was David B. Steinman.

"Prentiss Brown became a lawyer, took over his father's law prac- n St. Ignace and expanded it to include offices in Detroit, Chicago, Cleveland. Later he became a congressman and subsequently a senator. Throughout his career he never forgot his boyhood dream bridge across the Mackinac Straits.

"Dr. Steinman studied engineering and won his master's and Ph degrees at Columbia University. With a young partner and his first de space he entered an international bridge design competition for a bric in Brazil. He won it with a revolutionary design, and since that ti he has built more than 400 bridges.

"It was inevitable that the dreams of these two men, Brown a Steinman, should find common bond. It came when Mr. Brown beca head of the Mackinac Bridge Planning Organization. Dr. Steinman w brought in as a consulting engineer and later as the bridge designer.

"During those days, when there were arguments about the feasibil of spanning Mackinac Strait, Dr. Steinman invested large sums of own money in the preliminary work of planning and designing bridge. Mr. Brown led the fight to get approval and the financing, $10 000,000 worth."

Their Dreams Come True

The project was started in 1954 and completed three and a h years later. More than one million tons of steel and concrete were u in the construction of the 3,800 foot span, and three-quarters of t weight is under water, where it cannot be seen, in the massive foun tions and bases of the piers and the anchorages. The cables, span over 8,000 feet from anchorage to anchorage, are 24½ inches in diam Each cable contains 37 strains of 348 wires each, or a total of 12 parallel steel wires per cable. The strength of a single wire is 7 pounds, and the tensile strength of each cable is over 48,000 tons.

The construction of the Mackinac Bridge has given employment over 10,000 men in quarry, mine, shop, mill, office and field. On actual construction in the field over 2,500 men have been employed.

On the calculations, design, surveys, inspection, and supervisio construction, over 250 engineers have been engaged (under the direct of the consulting engineer) in office and field. This represents o 1,400,000 man-hours of engineering, most of it being highly specializ This is in addition to the engineering forces maintained by the seve contractors, in drafting rooms and estimating departments, and in m shop, and field. The total engineering on this work, including the c tractors organizations and the consulting engineers staff, may be e mated at well over 2,000,000 man-hours of engineering.

Dr. Steinman has always taken a deep and sincere interest in profession and in the various engineering and scientific societies in wh he holds membership both in the United States and abroad. He a life member of the American Association of Engineers and ser as its president in the 20's and contributed greatly to many of its act ties, in particular engineering ethics and registration.

Scholarships for Students Established by this Eminent Engineer

Just recently Dr. Steinman has made a grant of $10,000 to St. Lawnce University to establish the Holton D. Robinson Scholarships for udent aid, in memory of his late partner, Dr. Robinson, who was an umnus of St. Lawrence.

The grant, made from the funds of the David B. Steinman Foundan, specifies that each student recipient of a scholarship be asked to sume a moral obligation to make repayment to the University when can at any future time so as to help make the scholarship fund self-rpetuating. Dr. Steinman has specified a similar pledge at other intutions where he has established scholarships. The underlying thought to inculcate the spirit of giving to help successive generations of stunts. Dr. Steinman calls this a "moral chain-reaction" of obligation d opportunity.

Recalling his life-long indebtedness for scholarships and fellowships at made his own professional education possible, Dr. Steinman has paid those debts a hundred fold and, in addition, has made grants to long string of educational institutions. Some of these scholarship nds he has established in honor of friends and loved ones. At Mantan College he established the Arthur V. Sheridan Scholarship Fund memory of Dr. Sheridan, a dear friend and co-worker in professional ises. At Hunter College, he established the Irene H. Steinman Scholarp Fund in honor of his wife. At the University of Florida, an Irene Steinman Fund has been established for student aid. To date, Dr. inman has made grants to more than thirty educational institutions, an aggregate amount exceeding $400,000.

1958 SALARIES OF GRADUATES ACCORDING TO I.I.T.

According to a recent release of the Illinois Institute of Technology, rage starting salaries for 1958 engineering graduates are matching year's all-time high. Average starting pay for January and June ineering graduates at IIT was $470 a month, the same as last year.

The 1957 electronics boom brought electrical engineering starting ries to $515 a month last year, said Earl C. Kubicek, director of cement at the Institute. However, mechanical engineers, who are more ic in industrial application, commanded an average monthly salary $484 compared to last year's average of $465. The over-all average included starting salaries for chemical, civil, fire protection and ty, food, industrial, and metallurgical engineering, and mechanics duates.

High Points in A.A.E.'s Varied Activiti

Since 1915 when the Association was founded, the aims and purposes of the Association have followed one specific course: To improve the social and economic status of the professional engineer. Sometimes in order to progress intelligently it is well to stop and take stock of what has been accomplished; therefore, let's look at the record of this all-embracing, national engineering society.

THE young engineers who founded the Association in 1915 and eve one of the thousands of engineers who have at one time or another duri the past forty-three years, held membership in A.A.E., coupled with t engineers who are now members have had a vital part in establishing a maintaining an organization in which engineers of all branches, and in stages of professional development may cooperate to advance.

To them must go the credit for the years of pioneering in many unt fields of professional welfare work. The record looks something like th

American Association of Engineers has *supported campaigns for engine ing registration laws in 35 states* (all states now have laws).

Coached local leaders, supplied speakers and funds in 27 states.

Prepared and published "Survey of our Registration Laws" showi their weakness in comparison with licensure of doctors, lawyers, denti

Prepared and published studies of laws in operation, showing difficult of enforcement and administration.

Among the prominent leaders in the Society's registration moveme have been G. M. Butler, formerly Dean of Engineering, School of Min University of Arizona, C. J. Ullrich, engineer and lawyer; Pecos Calahan, now executive secretary of the Consulting Engineers Asso tion of California, Dr. David B. Steinman, Eminent Bridge Engine Donald M. Baker, Consulting Engineer of Los Angeles, and Herm A. Wagner.

Aided in forming the National Council of State Boards of Engineeri Examiners.

Participated in joint society conferences to draft and revise the Mo Law.

Crystallized and enunciated "Specific Principles of Professional Condu from actual "practice cases" and decisions.

Morris Llewellyn Cooke, well-known for his work in later years in the Rural Electrification Administration, and Dr. F. H. Newell, known as the Father of the U.S. Reclamation Service, president of A.A.E. in 1919 and 1920, led the A.A.E. campaign for higher ethical standards in those early days.

Prepared and published first "Code of Ethics," by Isham Randolph, president, A.A.E.

Prepared and published "A Vow of Service," under the able leadership of the world-renowned bridge engineer, Dr. D. B. Steinman, a past president of the Association.

blished studies on "ethical codes" of other professions and their methods of enforcing them.

In 1922 prepared for the American Academy of Political and Social Science, a brief history of ethics in the Engineering Profession at that time, the article appearing in THE ANNALS of May 1922. In 1955, the Association was again invited by the Academy to bring the subject up to date which it did furnishing a rather complete report entitled "Principles of Professional Conduct in Engineering," the article appeared in the January, 1955, issue of THE ANNALS.

neered in employment service and vocational guidance.

Freed engineers of reliance on commercial employment agencies.

Placed more than 35,000 engineers in positions.

Engaged in systematic study of employers' desires as shown in employment service data.

Published "The Engineer as the Employer Sees Him," an outstanding survey in which hundreds of captains of industry were questioned on . How do you view unionism among engineers? 2. What, in your opinon, should the Engineer do to obtain adequate compensation? 3. What oes he lack that prevents him from receiving adequate compensation nd from becoming an Executive? Though published some years ago, plies still fit today's problems, and conditions.

ublished Vocational Guidance in Engineering Lines, a 522-page book, repared under the competent guidance of Dr. J. A. L. Waddell, the oted Bridge Engineer, endorsed by such men as the Hon. Herbert oover, Gen. John J. Pershing, Dr. Nicholas Murray Butler, Dr. Michael Pupin, Dr. Elwood Mead, and many others equally famous. The purose of the book was to acquaint young men embarking on an engineering reer with the various branches of the profession.

ne various chapters were prepared by eminent engineers, all leaders in eir respective fields.

rough the Society's Service Department it has continued to give voca-

tional guidance to young men interested in engineering, and has supplie information to hundreds of individuals and schools.

Published "The Market for Engineering Services, 1940-1950." A su vey of the entire employment field with salary statistics, job specification etc.

Published "Before and After VJ Day," a survey of the market fo engineers at that time.

Published series of articles on employment opportunities in non-enginee ing fields for men with engineering training; also bulletins on "sellin services."

Promoted efficiency of engineers.

Through chapters established extension courses in English, public speal ing, accountancy, business law, etc.

Stimulated interest in self-instruction, through technical books, mee ings, etc.

Published instructive and inspirational articles prepared by employe deans of engineering schools, sociologists, etc.

Pioneered in classification of engineering schools.

Published articles urging broadening of engineering training.

Conducted campaign under the Society's committee headed by Herman Wagner, ably assisted by The Chicago Daily News to eliminate dishon trade and correspondence schools and induce substantial schools to set and maintain higher standards. Was instrumental in forming the Natio Home Study Council, to police the correspondence schools field. A volu tary organization of private home study schools, whose most rece published purpose is to promote sound educational standards and ethi business practices within the home study field.

Conducted campaign for better compensation of engineering educato and better qualified teachers in the engineering schools.

Formed student chapters to acquaint prospective engineers with econon and professional problems.

Conducted campaign for more adequate compensation for engineers.

Secured increases averaging $5,000,000 annually for railway technic men during the time Wm. H. Finley, President of the C.N.W. R.I was president of A.A.E.

Secured substantial increases for Navy technical men.

Secured equitable adjustment of retirement benefits for federal civ service employees.

Prepared and supported salary schedules for municipal employees.

Prepared and supported salary schedules for county employees.

Directed campaigns and secured salary increases for municipal enginee in 8 cities.

Directed campaigns and secured increases for state and county engineering employees.

Published Specifications for Engineering Positions in the Highway Field, and Recommended Schedule of Fees for Engineers in Public Service. Published "Standards on the Classification and Compensation of Professional Engineering Positions," and "Incomes of Professional Engineers in Public Employment," in 1948.

In 1958 published an informative survey entitled "Compensation of Professional Engineers Trends from 1930 to 1958" prepared under the able leadership of Arthur Richards, an authority on the subject.

Conducted studies and prepared and published schedule of fees for engineers in independent practice.

Published "How to Employ and Use Engineering Services," a widely distributed and well received report of the Society's national committee on Services and Fees of Practicing Engineers, under the able chairmanship of Paul Hansen, then with the firm of Hansen and Greely, consulting engineers.

Published "Publicity Methods for Engineers."

pposed government intrusion on field of private practice.

Opposed legislation intended to impose unfair restraints on patents and ndividual rights to benefits from inventions.

Opposed measures designed to "regiment" technology (Kilgore bills).

)pposed "free engineering services" of manufacturers, dealers, etc.

)pposed appointment of non-engineers to positions involving technological knowledge and skills.

)pposed unionization of professional employees because of its tendency o destroy unity in the profession.

Blocked unionization of railway and Navy technical men.

Conducted systematic study of Wagner Act in operation:

Published "Technologists' Stake in the Wagner Act," a 270-page book ntended to give engineers a comprehensive picture of their position under ne Act. Widely distributed among groups of engineers, industry and braries. Still the basis of all studies and organization work in Collective argaining.

'ublished series of articles called "Exploded Views of the Wagner Act in Professional Engineer."

ided employee groups opposed to absorption in heterogeneous unions.

ampaigned for amendment of the Wagner Act to restore freedom of ssociation to professional engineers.

ublished "Technologists' Stake in the Taft-Hartley Act," to bring ngineers up to date on the subject.

Provided Personal Service and Benefits to Individual Members.

Legal research and guidance. Information and advice on patents and inventions. Book and equipment information and service. General information service. Miscellaneous personal service. Accident and dismemberment insurance. Accident and Health Insurance. Special accident and medical insurance.

Stimulated Public Service in the Profession.

Championed National Department of Public Works.

Campaigned for "engineers in engineering positions."

Supported Civil Service Reforms; championed rights of individuals and groups under civil service regulations.

Opposed regimentation of engineers; demanded effective use of engineers in defense program.

Aided all branches of government in finding personnel for special services (civilian and military) during World War I and II.

Assisted federal agencies in securing data for special studies (fuel, highways, conservation, personnel, etc.)

Publicized "reconversion" and "demobilization" plans and sought co-operation of engineers.

Made a survey of the civic attitudes and activities of engineers throughout the nation, contacting various civic groups, such as Lions, Kiwanis clubs, Rotarians, etc. to ascertain what part engineers played in civic programs. A most interesting survey.

Conducted systematic campaign to improve public relations of profession

Coached chapters in publicity techniques; engaged world famous public relations experts to direct the project. An outstanding chapter in this field is the Phoenix Chapter, A.A.E., which has a marvelous record for civic participation and achievements.

Established contacts, and released volume of publicity on achievements of engineers and the social value of their work.

Recognized public service by individual engineers.

Acquainted many communities with work of their engineers.

Organized "Public Relations Committee of the Whole," with three working divisions, "Fact Finders," "Clipping Club," and "Listeners-in" Club.

Made and published systematic study of engineering's portrayal in advertising, fiction, movies, radio, columns, editorials, news stories.

Sponsored radio broadcasts, meetings, etc., to emphasize the social and economic importance of engineering—society's reliance on good engineering.

Consistently emphasized the "human side of engineering"—service to the profession and service to society.

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etwork Synthesis, 2 Vols. David F. uttle, Jr., Prof., E. E. Stanford Univ. 3.50. An initial volume in a two- olume work presenting the principles synthesis of electric networks in hich steady-state behavior as a func- on of frequency is all-important. Vol. covers networks with two terminals. ol. 2 will treat those with four ter- inals. The author gathers together the portant advances in network syn- esis of the past two years and adds is to the classical material.

levision In Science And Industry, K. Zworykin, E. G. Ramberg, L. E. ory, RCA $10. The authors seek, in s book, to explore the function of evision as an extension of human ht—variously called closed-circuit or lustrial TV to distinguish it from the oadcast function. They also describe tools which have been developed to lize it. Also described are stereo evision, specialized television meth- s in research, tv microscopy, etc. A od book.

chnical Report Writing, James W. uther, Asst. Dean, College of Engrg., iv. of Wash. $2.95. Paper covers. The n of the author is to make available undergraduates and practicing engi- rs alike a short, concise, yet com- e treatment of the fundamentals of hnical writing, and he has succeeded giving a well organized, easy-to-fol- text.

Analytical Mechanics For Engineers, Fred B. Seely, N. E. Ensign and P. G. Jones, all professors, Univ. of Ill. 5th ed. $7.25 . . . A classic mechanics text, now fully revised and modernized in line with current theory and practice. Many new problems which involve actual engineering.

Motion And Time Study, 4th ed. Ralph M. Barnes, Prof., Univ. of Calif. $9.25. This excellent book revised to present new material in the area of motion and time study plus more and diverse illustrations.

Queues, Inventories And Maintenance, Philip M. Morse, M.I.T. $6.50. The analysis of operational systems with variable demand and supply, designed for use as a practical handbook. Queuing problems are dealt with from the standpoint of the Kolmogorov equations relating the probabilities, and numerous tables are included, also many graphs.

Synthesis Of Passive Networks, Ernst A. Guillemin, M.I.T. $15. Presents the theoretical basis for linear passive synthesis procedure. Good understanding of essential math and basic circuit analysis is considered pre-requisite to the use of this excellent book.

Switching Circuits And Logical Design, Samuel H. Caldwell. Deals with the methods used to handle problems of circuit synthesis using various kinds of components, and presents the principles of switching circuit design. Much of

the material has not appeared in published form before. $14.

Automation In Business And Industry, edited by E. M. Grabee, Sr., Staff Consultant on Automation, Ramo-Wooldridge Corp. $10. Based on lectures given by prominent engineers and scientists at the Univ. of Calif. Briefly, the text answers the questions: "What is new?" and "How is it used?" Considerable attention is paid to Electronics, Computers, and data processing.

Linear Feedback Controls, Analytical Design of, George C. Newton, Jr., L. A. Gould and J. F. Kaiser, all of M.I.T. $12. Presents analytical techniques for solving practical control problems through the use of simplified models and constraints, and is intended for engineers and scientists who have had some graduate training. A well organized and instructive text.

Heat Transfer, Elements of, Max Jacob and G. A. Hawkins, 3rd ed. $6.75. Presents fundamental concepts of the field and new topics of importance. New table on thermal conductivity of liquid metals, and many other new sections added including gas radiation.

Ceramic Fabrication Processes, W. D. Kingery, Assoc. Prof., M.I.T. $9.50. 7x11 in size, the book is the outgrowth of the 1956 special summer program in Ceramics at M.I.T. It provides both the technical basis and present practice of ceramic fabrication, showing the relationship between principles and the art. It is the only book available to treat both traditional and novel ceramic methods comprehensively.

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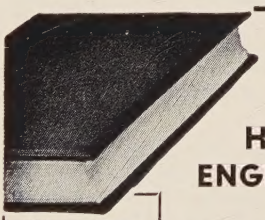

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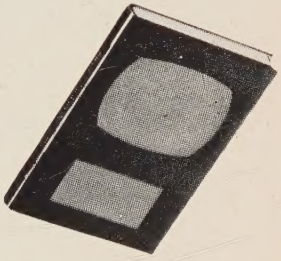

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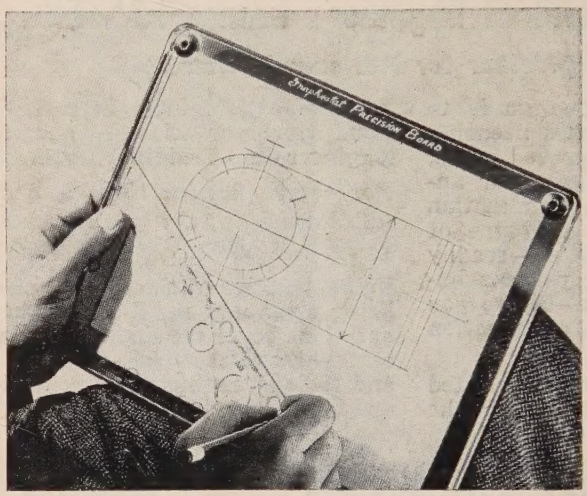

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